

(1)

CHM129

Problem Set #1

① Molar Mass $\text{PtCl}_2(\text{NH}_3)_2$

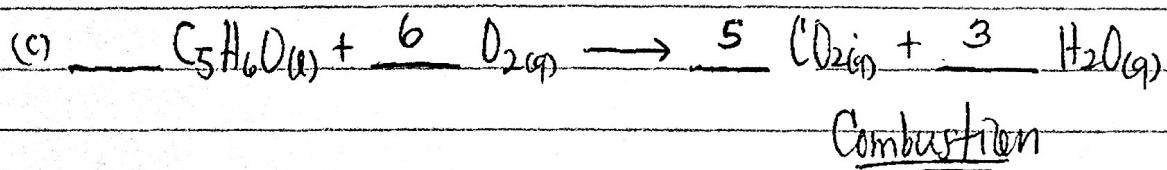
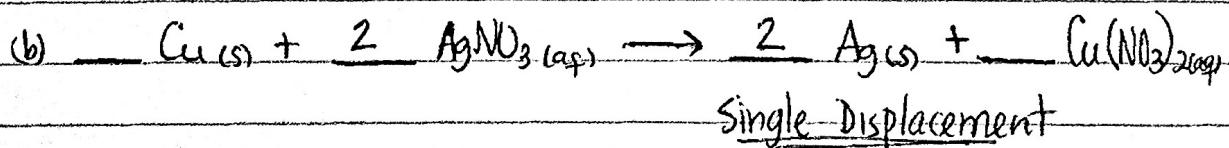
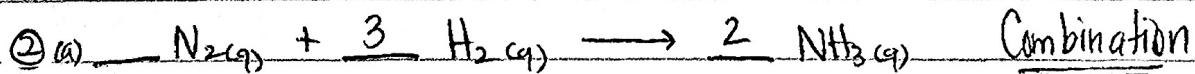
$$\begin{aligned}
 \text{Pt} &: 1 \times 195.08 \text{ g/mol} = 195.08 \text{ g/mol} \\
 \text{Cl} &: 2 \times 35.45 \text{ g/mol} = 70.90 \text{ g/mol} \\
 \text{N} &: 2 \times 14.01 \text{ g/mol} = 28.02 \text{ g/mol} \\
 \text{H} &: 6 \times 1.01 \text{ g/mol} = 6.06 \text{ g/mol} \\
 &\qquad\qquad\qquad 300.06 \text{ g/mol}
 \end{aligned}$$

$$\% \text{ Pt} = \frac{(1)(195.08 \text{ g/mol})}{300.06 \text{ g/mol}} \times 100 = 65.01\%$$

$$\% \text{ Cl} = \frac{(2)(35.45 \text{ g/mol})}{300.06 \text{ g/mol}} \times 100 = 23.63\%$$

$$\% \text{ N} = \frac{(2)(14.01 \text{ g/mol})}{300.06 \text{ g/mol}} \times 100 = 9.338\%$$

$$\% \text{ H} = \frac{(6)(1.01 \text{ g/mol})}{300.06 \text{ g/mol}} \times 100 = 2.02\%$$



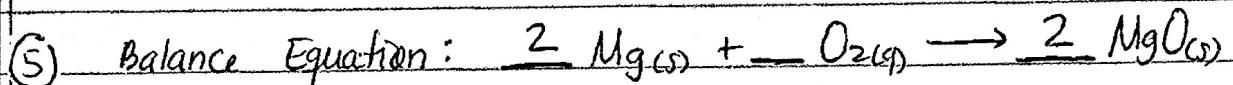
(2)

$$③ (a) 1.0 \times 10^{-2} \text{ mol NaCl} \left(\frac{58.44 \text{ g NaCl}}{1 \text{ mol NaCl}} \right) = \underline{\underline{0.58 \text{ g NaCl}}}$$

$$(b) 76.5 \text{ g TiO}_2 \left(\frac{1 \text{ mol TiO}_2}{79.87 \text{ g TiO}_2} \right) = \underline{\underline{0.958 \text{ mol TiO}_2}}$$

$$(c) 0.105 \text{ mol CO}_2 \left(\frac{6.022 \times 10^{23} \text{ CO}_2 \text{ molecules}}{1 \text{ mol CO}_2} \right) = \underline{\underline{6.32 \times 10^{22} \text{ CO}_2 \text{ molecules}}}$$

$$④ 55.8 \text{ g Pb(NO}_3)_2 \left(\frac{1 \text{ mol Pb(NO}_3)_2}{331.2 \text{ g Pb(NO}_3)_2} \right) \left(\frac{2 \text{ mol KI}}{1 \text{ mol Pb(NO}_3)_2} \right) \left(\frac{166.00 \text{ g KI}}{1 \text{ mol KI}} \right) \\ = \underline{\underline{55.4 \text{ g KI}}}$$



$$10.1 \text{ g Mg} \left(\frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} \right) \left(\frac{2 \text{ mol MgO}}{2 \text{ mol Mg}} \right) \left(\frac{40.31 \text{ g MgO}}{1 \text{ mol MgO}} \right) = 16.7 \text{ g MgO}$$

$$10.5 \text{ g O}_2 \left(\frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} \right) \left(\frac{2 \text{ mol MgO}}{1 \text{ mol O}_2} \right) \left(\frac{40.31 \text{ g MgO}}{1 \text{ mol MgO}} \right) = 26.5 \text{ g MgO}$$

Limiting Reagent: Mg

Theoretical Yield: 16.7 g MgO

$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theo. yield}} \times 100$$

$$= \frac{11.9 \text{ g MgO}}{16.7 \text{ g MgO}} \times 100 = \underline{\underline{71.3\%}}$$

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$$6) (a) \frac{58.80 \text{ g C}}{12.01 \text{ g C}} = 4.896 \text{ mol C}$$

$$\frac{9.87 \text{ g H}}{1.01 \text{ g H}} = 9.77 \text{ mol H}$$

$$\frac{31.33 \text{ g O}}{16.00 \text{ g O}} = 1.958 \text{ mol O}$$

$$\frac{C_{4.896}}{1.958} \frac{H_{9.77}}{1.958} \frac{O_{1.958}}{1.958} \Rightarrow (C_{2.5} H_{4.99} O) \times 2$$

C₅H₁₀O₂ ← Empirical Formula

$$n = \frac{\text{MM Molecule}}{\text{MM Emp. Form.}} = \frac{102.13 \text{ g/mol}}{102.15 \text{ g/mol}} \approx 1$$

Molecular Formula: C₅H₁₀O₂

$$(b) \frac{8.59 \text{ g CO}_2}{44.01 \text{ g CO}_2} \left(\frac{1 \text{ mol CO}_2}{1 \text{ mol CO}_2} \right) \left(\frac{1 \text{ mol C}}{1 \text{ mol CO}_2} \right) \left(\frac{12.01 \text{ g C}}{1 \text{ mol C}} \right) = 2.34 \text{ g C}$$

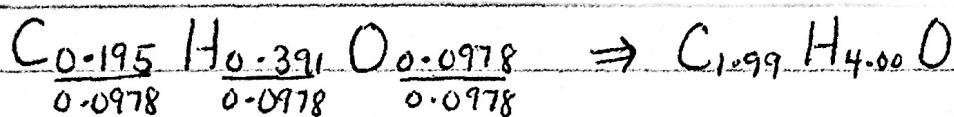
$$\frac{3.52 \text{ g H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \left(\frac{1 \text{ mol H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \right) \left(\frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} \right) \left(\frac{1.01 \text{ g H}}{1 \text{ mol H}} \right) = 0.395 \text{ g H}$$

$$\text{mass O} = 4.30 \text{ g sample} - 2.34 \text{ g C} - 0.395 \text{ g H} = 1.565 \text{ g O}$$

$$2.34 \text{ g C} \left(\frac{1 \text{ mol C}}{12.01 \text{ g C}} \right) = 0.195 \text{ mol C}$$

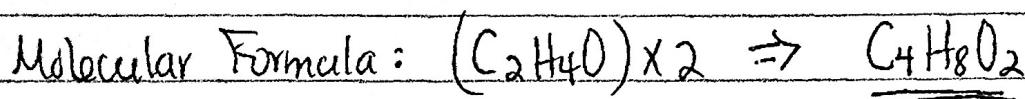
$$0.395 \text{ g H} \left(\frac{1 \text{ mol H}}{1.01 \text{ g H}} \right) = 0.391 \text{ mol H}$$

$$1.565 \text{ g O} \left(\frac{1 \text{ mol O}}{16.00 \text{ g O}} \right) = 0.0978 \text{ mol O}$$



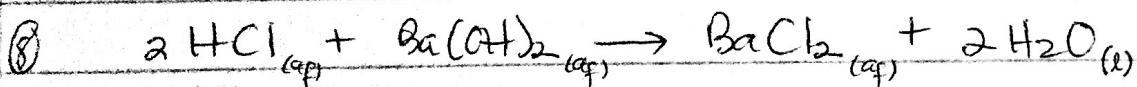
C₂H₄O ← Empirical Formula

$$\frac{n = \text{MM Molecule}}{\text{MM Emp. Form.}} = \frac{88.11 \text{ g/mol}}{44.06 \text{ g/mol}} = 2$$



$$(7) \text{ (a)} \quad M = \frac{\text{mol solute}}{\text{L soln}} \quad \text{mol NaCl} = M(L) = (0.0475 \text{ M})(0.250 \text{ L}) \\ = 0.0119 \text{ mol NaCl} \\ \text{grams NaCl} = 0.0119 \text{ mol NaCl} \left(\frac{58.44 \text{ g NaCl}}{1 \text{ mol NaCl}} \right) \\ = 0.694 \text{ g NaCl}$$

$$(b) \quad C_1V_1 = C_2V_2 \quad V_1 = \frac{C_2V_2}{C_1} = \frac{(0.500 \text{ M})(0.450 \text{ L})}{10.0 \text{ M}} \\ = 0.0225 \text{ L} = 22.5 \text{ mL of } 10.0 \text{ M HNO}_3$$



$$(a) \quad \text{mol HCl} = (0.150 \text{ M HCl})(0.125 \text{ mL}) = 0.01875 \text{ mol} = 0.0188 \text{ mol HCl}$$

$$0.0188 \text{ mol HCl} \left(\frac{1 \text{ mol Ba(OH)}_2}{2 \text{ mol HCl}} \right) = 9.38 \times 10^{-3} \text{ mol Ba(OH)}_2$$

$$\text{L Ba(OH)}_2 = \frac{9.38 \times 10^{-3} \text{ mol Ba(OH)}_2}{0.150 \text{ M}} = 0.0625 \text{ L} = 62.5 \text{ mL of } 0.150 \text{ M Ba(OH)}_2$$

(5)

$$(b) \quad 0.0188 \text{ mol HCl} \left(\frac{1 \text{ mol BaCl}_2}{2 \text{ mol HCl}} \right) = 9.38 \times 10^{-3} \text{ mol BaCl}_2$$

$$[\text{BaCl}_2] = \frac{9.38 \times 10^{-3} \text{ mol BaCl}_2}{0.188 \text{ L}} = 0.0500 \text{ M BaCl}_2$$

$$\text{total volume} = 125 \text{ mL} + 62.5 \text{ mL} = 187.5 \text{ mL}$$